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HYDRONEAL GENERATOR, MODEL NX

15 July 1960

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Memo Report No. T-60-19 15 July 1960
Project No. 8-1034

TO: Chief, Demolitions and Fortifications Branch, USAERDL

FROM: Evaluation Engineering Branch
Mechanical Engineering Department
U. S. Army Engineer Research and Development Laboratories
Fort Belvoir, Virginia

SUBJECT: Hydroneal Generator, Model NX (Built for the U. S. Navy under Contract 12864-58 by Baker & Co. Inc., Newark, N. J.)

1. During the period August 1957 thru May 1958, a Hydroneal Generator, Model NX, was tested by these Laboratories for the Office of Naval Research. The results of that test were reported to the Office of Naval Research in report No. T-58-47. After completion of the test the generator was stored at these Laboratories awaiting disposition instructions.

2. Demolitions and Fortifications Branch, acting for the Office of Naval Research, requested 18 September 1959, that the generator be operated one day each month for a period of one year at a production rate of 4000 SCFH and 1800°F retort temperature. All pertinent temperatures, pressures, flows and other operating variables were to be recorded and reported in a cumulative report to be submitted at the end of the test period. Mr. S. Haven was designated representative of the Office of Naval Research.

3. The plant was inspected, overhauled and put in operating condition 9-10 November 1959. Operation was started 12 November. The plant was operated 2 days in November 1959, 2 days in January, one day in February, 3 days in March, 2 days in April and 1 day in May 1960. The No. 2 retort burned out on 24 May 1960 and tests were discontinued awaiting further instructions from the Office of Naval Research. During the periods the plant was operated, Mr. S. Haven was kept informed of all data obtained during operation, difficulties encountered, and the final failure of the No. 2 retort.

4. It will be noted from a study of the operating data and operation log, attached to this report, that temperatures in the retorts occasionally exceeded 1800°F. This was due to difficulty in adjusting retort burner fuel supply valves to the exact amount of fuel required to maintain 1800°F. Authority to wire around defective electrical controls was given verbally by Mr. Haven.

5. Instructions are requested as to repair and additional operation or disposition of the unit.

Prepared by

S. E. LYTLE
Chief, Gas Laboratory Section

Approved by

O. A. KINZER
Chief, Evaluation Engineering Branch

1 Incl:
Operating Data
with Operation Log

OPERATIONAL LOG RECORD
Hydroneal Generator

9 Nov 59	Installed new battery, cleaned and adjusted distributor points, started motor. Vehicle brakes bad. Brakes repaired at motor pool. Installed stack on retorts and checked plant, including gas hose, pump, electric terminals, electric cable to generator etc. Filled fuel tanks.
10 Nov 59	Filled ammonia tank to recommended per cent and pressure in storage tank at 60 psig. Turned on heaters to bring ammonia up to proper temperature. Turned on current to operating circuit. Limitrol was not functioning properly and called in electrician to check electrical circuits. Found one optional condenser bad. It was cut out of the circuit and plant would then operate.
12 Nov 59	
0730	Started 5 KW generator.
0745	Turned on 220 volt current to plant. Turned on heaters and current to operating compartment.
0755	Started plant according to operating instruction manual.
0800	Burners started. Thermocouples not recording.
0820	Turned burners off and installed new wires to thermocouples.
0930	Started burners, temperatures coming up normally.
0950	Turned on gaseous hydrogen - 3000 CFH.
1000	First reading at 4000 CFH. Having trouble with ammonia pump. Liquid seems to flash off causing gas lock. Will pump intermittenly when bleeding off gaseous ammonia. Tank per centage low.
1530	Plant shut down.
13 Nov 59	
0745	Started 5 KW generator.
0800	Current to plant.
0815	Burners started. Still having trouble with ammonia pump. Flow 4000 CFH. Per cent of H_2 not known at these temperatures. Difficulty in maintaining 1800°F retort temperature.
1300	Plant shut down. Used all anhydrous ammonia on hand.
Dec 1959	No operation. No ammonia available until late January.
27 Jan 60	
1230	Started 5 KW generator.
1240	Current to plant. Started heater and filled ammonia tank.
1245	Operators compartment on.
1250	Burners on. Warming up retorts. Ammonia pump fills tank when pressure is equal to or less than in cylinder. Regulator valve stuck. Pressure 30 psig. Repaired by turning in and backing out regulating bolt. Regulator operating okay.

1600 Plant shut down.

28 Jan 60

0730 Started 5 KW generator.
0740 Current to plant and operators compartment. Heaters on.
0755 Burners on. No trouble on start up. Pressures in tank and cylinder approximately the same. Pump working okay when bleed valve vented slightly to atmosphere to eliminate gaseous ammonia. Flow meter leaking. Tightened top and bottom bolts and stopped leak. Tank heaters not up to efficiency.
1530 Plant shut down.

29 Feb 60

1230 Started 5 KW generator and turned on current to plant and operators compartment.
1235 Started burners. Plant operating okay except ammonia pump. Having trouble with limitrol due to bad connections on thermocouples.
1400 Plant shut down.

1 Mar 60

0800 Started 5 KW generator.
0815 Turned on current to plant. Turned heaters on.
0825 Started burners. Having ammonia pump trouble.
1000 Plant shut down.

25 Mar 60

0730 Started 5 KW generator.
0740 Turned current into plant.
0745 Heaters turned on.
0750 Smoke coming from control panel. Turned off current to plant. Smoke coming from 7.5 volt transformer that supplies current for lights and DC current. Rewired most of panel. Wiring run from master switch by-passing flow guard, alarm, green light, limitrol. Connected thermocouple wires to cam motor. No. 1 thermocouple not recording.
1130 Plant shut down. Rest of day spent in rewiring. Installed check valve in ammonia line from pump.

28 Mar 60

0730 Started 5 KW generator.
0800 Burners turned on. No. 1 thermocouple not recording.
0900 Increased H_2 flow to 4000 CFH. Plant running smoothly. Operator has to be alert at all times. All safety devices by-passed. Limitrol recording temperatures on No. 2 and No. 3 retorts. Wiring and thermocouple okay. Cam on timer needs cleaning. Ammonia pump operating okay since check valve was installed in line.
1500 Plant shut down.

25 Apr 60	
0730	Started 5 KW generator.
0745	Set up pump and ammonia cylinder and turned on pump. Pump leaking. Repaired pump.
0955	Started pump. Working okay. Tank pressure 188 psig, per centage 62%.
1000	Burners started. No. 1 thermocouple not recording. Installed new thermocouple.
1035	Turned on ammonia gas to retorts.
1115	Burners cut out. Burners kept cutting out at one minute intervals. Found heater coil in burner switches bad. Rewired direct to switch, by-passing heater coil.
1330	Started plant. Plant operating okay.
1600	Plant shut down.
26 Apr 60	
0755	Started 5 KW generator.
0800	Turned on burners.
0850	Turned on ammonia to retorts.
0920	Set flow at 4000 CFH. Burner nozzles need cleaning. Too much difference between temperature and pressure ratio.
1525	Plant shut down.
24 May 60	
0730	Started 5 KW generator.
0830	Turned on burners.
0930	Turned on ammonia to retorts.
1000	Set flow at 4000 CFH.
1200	No. 2 retort burned out. Plant shut down.

SECURITY CLASSIFICATION (*If any*)

DISPOSITION FORM

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FILE NO.	SUBJECT
ERD HE	Test of Hydroneal Generator, Model NX, for U. S. Navy

TO Ch, Demolitions & Fort Br FROM Ch, Eval Engrg Br DATE 26 July 1960 COMMENT NO. 1
THRU: ~~Ch, Mech Engrg Dept~~ Sac

1. Attached are 6 copies of report of test of Hydroneal Generator, Model NX, in compliance with your work request dated 18 September 1959, our Work Order No. T-60-19.

2. It is understood that you will forward copies of the report to the Office of Naval Research, U. S. Navy.

3. This correspondence is marked "FOR OFFICIAL USE ONLY" solely because of the addition of inclosures, Test of Hydroneal Generator, Model NX. When these inclosures are removed protective markings will be cancelled.

O. A. KINZER, Chief
Evaluation Engineering Branch

1 Incl
Hydroneal Generator,
Model NX (6 cys)

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U. S. GOVERNMENT PRINTING OFFICE: 1952 O - 986875

GAS LABORATORY SECTION — USAEREDL — W. O. No. — Sheet No. 1 — HYDROGEN GENERATOR

DATE	Line	Obs.	TIME On	TIME Off	Oprtg Time Hrs	Oprtg Time Min	Amb Air	Bar	REPORT No. 1 Vapor Press	Oil Press	Temp	CFH	REPORT No. 2 Oil Press	Temp	CFH	REPORT No. 3 Oil Press	Temp	CFH	NH_3 Tank Pres	NH_3 Vapor Pres	NH_3 Tank Level	Total CFH	NH_3 Bottle Used	REMARKS
12 Nov 59	1		1000		-	-			12	120	1725	1330	120	1725	1333	120	1740	1333	80	27	70%	4000	1	Note: See attached operating log
	2		1100		1	-			13	120	1730	1330	120	1730		120	1740		60	27	65			Pressure per operational
	3		1130		1	30			12.5	120	2030	1330	120	2040		120	2040		55	26.5	60			datasheet.
	4		1200		2	-			13	120	2480	1330	120	2180		120	2175		55	26	55		2	
	5		1230		2	30			14.75	80	2130	1330	80	2100		80	2130		62	27.25	58			
	6		1300		3	-			15	80	2000	1200	80	2000	1200	80	2000	1200	75	28	70	3600		Back press. valve closed to much
	7		1330		3	30			18	90	1950	1334	90	1955	1333	90	1960	1334	70	27.5	66	4000		
	8		1400		4	-			18	100	1980	1333	100	1970		100	1980	1333	65	27.5	58			
	9		1430		4	30			17.5	100	1980	1333	100	1980		100	1990		65	27.5	60		3	
	10		1500		5	-			17.5	80	1950	1333	80	1950		80	1960		66	27.5	56			Added 1.5 gals. Fuel oil
	11			1530	5	30			12.5	75	1840	1333	75	1840		75	1840		65	27.5	52			
	12																							
13 Nov 59	13		0815		-	-																		
	14		0900		-	45			14	105	1800	1333	105	1800	1333	105	1800	1333	65	27	50%	4000	1	
	15		0930		1	15			15	95	1820		95	1820		95	1830		60	27	50			
	16		1000		1	45			15	95	1860		95	1860		95	1860		45	27	45		2	
	17		1030		2	15			14	90	1860		90	1860		90	1860		40	27	40			
	18		1100		2	45			14	90	1900		90	1900		90	1900		40	27	36			
	19		1130		3	15			15	80	1820		80	1810		80	1820		40	27	39			
	20		1200		3	45			15	80	1840		80	1840		80	1840		50	27	50		3	
	21		1230		4	15			13.5	80	1850		80	1850		80	1850		60	27.5	50			
	22			1300	4	45																		
	23																							
27 JAN 60	24		1930		-	-			-															
	25		1400		-	30			11	80	1600	1000	80	1600	1000	80	1600	1000	75	27	70%	3000	1	
	26		1430		1	-			11	100	1700	1334	100	1700	1334	100	1700	1334	90	28	68	4000		
	27		1500		1	30			11	120	1800		120	1800		120	1800		80	28	68			
	28		1530		2	-			11	120	1900		120	1900		120	1900		70	28	70			
	29			1600	2	30			12	120	1900		120	1900		120	1900		68	28	68		2	
	30																							
28 JAN 60	31		0800		-	-																		
	32		0830		-	30			12.5	125	1700	1000	125	1700	1000	125	1700	1000	80	27.5	60%	3000	1	
	33		0900		1	-			11.5	140	1850	1334	140	1850	1334	140	1850	1334	65	27	70	4000		
	34		0930		1	30			10	140	1915		140	1910		140	1915		66	28	68			
	35		1000		2	-			10.5	120	1920		120	1910		120	1920		75	26	65		2	5 gals #2 Diesel Fuel Added
	36		1030		2	30			11	120	1950		120	1945		120	1955		95	26	60			
	37		1100		3	-			12	115	1950		115	1950		115	1960		110	26	52			
	38			1130	3	30			12	115	1950		115	1950		115	1950		115	26	45		3	
	39		1230		3	30																		
	40		1300		4	-			12.5	100	1750	1334	100	1750	1334	100	1750	1334	80	26	60	4000		
	41		1330		4	30			12.5	120	1850		120	1850		120	1850		75	26	56			2.5 gals. #2 Diesel Fuel added
	42		1400		5	-			10	120	1600	1000	120	1600	1000	120	1600	1000	70	26	66	3000		
	43		1430		5	30			12.5	120	1950	1334	120	1950	1334	120	1950	1334	75	26	69	4000	4	
	44		1500		6	-			13	120	1950		120	1950		120	1950		70	27.5	80			
	45			1530	6	30			13	120	1975		120	1975		120	1975		70	26	75			
	46																							
	47																							
	48																							

GAS LABORATORY SECTION — USAMEDL — W. O. No. — Sheet No. 2 — HYDROGENAL GENERATOR

DATE	Line	Obs.	TIME On	TIME Off	Operg Time Hrs	Operg Time Min	Amb Air	Bar	Vapor Press	REPORT No. 1 Oil Press	Temp	CFH	REPORT No. 2 Oil Press	Temp	CFH	REPORT No. 3 Oil Press	Temp	CFH	NH_3 Tank Pres	NH_3 Vapor Pres	NH_3 Tank Level	Total CFH	NH_3 Bottle Used	REMARKS
29 FEB 60	1		1200		-	-			12	155	1800	1000	155	1810	1000	155	1720	1000	90	28	73%	3000		Note: See attached operating log
	2		1200		1	-			13	110	1890	1334	110	1900	1334	130	1820	1334	89	28	66	4000		record for operational
	3			1400	2	-			13	120	1900	1334	110	1900	1334	120	1900	1334	110	28	68	4000	1	details.
	4																							
1 MAR 60	5		0800		-	-																		
	6		0900		1	-	24			160	1740	1000	160	1780	1000	160	1750	1000	60	27	70%	3000	1	
	7			1000	2	-				100	2000	1334	160	2000	1334	160	2000	1334		28	60	4000		
	8																							
25 MAR 60	9		0830		-	-																		
	10		0930		1	-			11.5	120	1800	1334	120	1790	1334	120	1700	1334	70	28	65%	4000		
	11		1030		2	-			12	100	1900	↓	100	1900	↓	110	1850	↓	91	28	55			
	12			1130	3	-			12	100	1920	↓	100	1925	↓	110	1850	↓	120	28	50	↓		
	13																							
28 MAR 60	14		0800		-	-																		
	15		0830		0	30				125		1000	125	1640	1000	125	1640	1000	90	28	71%	3000	3	
	16		0900		1	-				125		↓	125	1800	↓	125	1760	↓	80	28	67	↓	1	25 gal. Fuel oil added
	17		0930		1	30				120		1334	120	1840	1334	125	1840	1334	85	28	70	4000		
	18		1000		2	-				105			105	1860		120	1840		102	28	66			
	19		1030		2	30				95			95	1820		120	1850		125	28	65		1	
	20		1100		3	-				95			95	1840		120	1850		130	28	67			
	21		1130		3	30				90			90	1760		110	1780		134	28	63			
	22		1200		4	-				90			90	1750		110	1750		132	28	60			
	23		1230		4	30				95		↓	95	1780	↓	110	1790	↓	132	28	70	↓	1	
	24		1300		5	-				120		1000	120	1730	1000	140	1775	1000	135	28	68	3000		
	25		1330		5	30				110		1334	110	1840	1334	110	1850	1334	120	28	66	4000		
	26		1400		6	-				95			95	1830		110	1820		128	28	68		1	
	27		1430		6	30				95			95	1810		120	1830		132	28	65			
	28			1500	7	-				95		↓	95	1830	↓	120	1860	↓	135	28	64	↓		
	29																							
25 APR 60	30		1000		-	-																		
	31			1100	1	-				130	1640	1000	120	1700	1000	120	1670	1000	90	28	66%	3000	1	
	32		1330		1	-																		
	33		1430		2	-	96		10	140	1720	1000	140	1730	1000	150	1700	1000	95	28	70%	3000		
	34		1500		2	30	95		12	110	1700	1334	110	1710	1334	130	1680	1334	45	28	72	4000		
	35		1530		3	-	95		12	110	1690	↓	110	1650	↓	130	1680	↓	100	28	66	↓		
	36			1600	3	30	93		12	130	1770	↓	130	1775	↓	150	1780	↓	110	28	72	↓		25 gal. Fuel oil added
	37																							
	38																							
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GAS LABORATORY SECTION — USAREUR — W. O. No. — Sheet No. 3 — HYDROGEN GENERATOR

DATE	Line	Obs.	TIME On	TIME Off	Operg Time Hrs	Operg Time Min	Amb Air	Bar	Vapor Press	RETORT No. 1 Oil Press	RETORT No. 1 Temp	RETORT No. 1 CFH	RETORT No. 2 Oil Press	RETORT No. 2 Temp	RETORT No. 2 CFH	RETORT No. 3 Oil Press	RETORT No. 3 Temp	RETORT No. 3 CFH	NH_3 Tank psig	NH_3 Vapor psig	NH_3 Tank Level	Total CFH	NH_3 Bottle Used	REMARKS
26 APR 60	1		0800		-	-																		Note: See attached operating log sheet for operational details.
	2		0900		1	-	75		10	150	1730	1000	145	1790	1000	160	1780	1000	105	29	68%	3000	1	
	3		0930		1	30	82		13	148	1810	1334	145	1860	1334	160	1860	1334	90	29	66	4000		
	4		1000		2	-	82		13	150	1880		145	1925		160	1900		92	28	70			
	5		1030		2	30	84		13.4	154	1925		145	1960		160	1940		105	28	68		1	
	6		1100		3	-	85		13.4	152	1880		140	1930		160	1960		120	28	69			
	7		1130		3	30	89		13.4	140	2010		132	2020		160	2000		123	28	68			
	8		1200		4	-	90		11.	130	2040		125	2000		145	2000		155	28	66		1	
	9		1230		4	30	90		12.8	130	2040		125	2020		140	2025		130	28	67			
	10		1300		5	-	90		13	120	2000		112	2020		120	1940		110	28	61			
	11		1330		5	30	93		13.	120	1950		115	2000		150	1970		130	28	68		1	
	12		1400		6	-	93		13	130	2020		115	2010		150	2000		146	28	66			
	13		1430		6	30	96		12.5	130	1900		115	2020		150	2000		157	28	66			
	14		1600		7	-	96		11.5	140	1930		100	2000		150	1920		155	28	62		1	
	15		1525		7	25	96		11.25	75	1720		75	1880		75	1660		160	28	72			
	16																							
24 MAY 60	17		0830		-	-																		20 gals. #2 Diesel fuel added
	18		0930		1	-				120	1710	1000	120	1720	1000	120	1690	1000				3000		
	19		1000		1	30				120	1780	1334	120	1820	1334	120	1780	1334				4000		
	20		1030		2	-				120	1820		120	1860		120	1820							
	21		1100		2	30				125	1880		115	2000		125	1880							
	22		1130		3	-				125	1910		105	2000		125	1920							
	23			1200	3	30								2300										
	24																							
	25																							
	26																							
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